Editorial

BIOINFORMATICS EDUCATION—A UK PERSPECTIVE

A recent survey undertaken by the Biotechnology and Biology Sciences Research Council (BBSRC) has shown that there is a strong and growing demand for trained bioinformaticians within the UK. The demand arises from a range of sectors, from the pharmaceutical and biotechnology industry, to academia and sequencing centres. Unsurprisingly, given the experience of other countries in Europe and the USA, there is now a broad agreement between all the main research funding agencies within the UK [Medical Research Council (MRC), BBSRC, Engineering and Physical Sciences Research Council (EPSRC), Particle Physics and Astronomy Research Council (PPARC), and the Wellcome Trust] that meeting the bioinformatics skill shortage is a high priority.

The provision of effective bioinformatics education raises a number of interesting challenges. First, the subject is by its nature multidisciplinary. This means that bioinformatics training requires an active collaboration between biological science and computer science departments—this can be non-trivial to manage. Secondly, the subject does not naturally ‘belong’ to any one research council. The provision of an integrated training support structure requires collaboration between funding agencies—another non-trivial challenge.

There has been considerable debate as to the type and scope of training which needs to be provided.

- At the undergraduate level most biology graduates should at least be introduced to bioinformatics. However, do all universities have staff that are in a position to be able to offer this training, and if not who should train the trainers?

- At the next level, what role should master-level (MSc) courses play? Clearly a 1-year master’s course can be very useful in developing computing and bioinformatics skills within (predominantly) biology graduates in a relatively short time. The question then arises as to whether such students meet any of the bioinformatics needs within industry? Master’s courses, and in particularly the new Master in Research (MRes) courses can also provide a useful springboard to allow biology graduates to explore bioinformatics before committing to a research career.

- In the longer term there needs to be well-defined PhD programmes in bioinformatics. In addition, courses such as summer schools, need to be provided to train non-bioinformatics biology graduates in the use of bioinformatics.

- There is also a need for fellowship schemes to help encourage bioinformatics PhD students develop their careers further, to the point where they can go on to become principle investigators in their own right and to encourage at least some to stay in academia.

- Most of the schemes discussed above are long term—they do not address the need to create bioinformatics principle investigators in the short term. One solution is to offer retraining packages to allow experienced scientists with good research skills to move into bioinformatics—not only from areas such as mainstream biology, but also from areas such as particle physics and astronomy where people have good skills in capturing and analysing large volumes of complex data.

- There is a need for bioinformatics training to be offered to people already within industry.

- It is difficult to formalize what a bioinformatics curriculum should contain given the current rapid changes. Might it be sensible to invest in a number of bioinformatics centres capable of acting as focal points for training and the dissemination of ‘best practice’?

An integrated bioinformatics training strategy is complex—involving a range of training from undergraduate courses to fellowship schemes. Such a strategy cannot be developed rapidly. It is also heavily dependent on there being sufficient trained academics and industrialists capable of delivering the range of teaching required.

Given all these ‘challenges’, the current situation within the UK is actually very encouraging. Most of the elements described above are now in place and students with bioinformatics skills are being produced. The research councils have collaborated extensively to produce a training package that at least appears to be integrated. For example, considering the needs outlined above.

- Summer schools are now being funded by BBSRC.

- MSc courses are funded by BBSRC and MRC.

- PhD studentships are being funded by BBSRC, EPSRC and MRC.

- Training fellowships are being funded by MRC, PPARC and Wellcome.

- The EPSRC is also actively attempting to fund the creation of new bioinformatics units.

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• CCP11 (Collaborative Computational Project in Bioinformatics) is being directly supported by the BBSRC to provide short bioinformatics training courses for UK academics and to organize international bioinformatics conferences within the UK to disseminate the latest research.

• The European Bioinformatics Institute is providing training courses for industry.

Specific details of all the masters courses on offer within the UK are available at the CCP11 website (http://www.hgmp.mrc.ac.uk/CCP11/). Details on the various research council schemes are available from the web site of each council (http://www.bbsrc.ac.uk, http://www.mrc.ac.uk, http://www.epsrc.ac.uk, http://www.wellcome.ac.uk).

The current successes can be mapped back to inherent environmental factors and a key policy decision. First, the UK has a strong biotech and pharmaceutical sector. These key industries made it very clear to the research councils their needs in this area. In addition, industry has been very supportive of the training initiatives on offer, for example offering large numbers of properly funded research projects for masters students and helping to fund a number of courses. Secondly, the UK hosts a number of world-class sequencing centres, for example the HGMP and the Sanger Centre, both based at Hinxton, Cambridge, raising both the demand and the profile of the discipline. There was also a strong academic tradition in areas such as structural biology, which could be adapted to fit a bioinformatics profile and a number of existing masters courses which were already delivering training close to what was required, for example the MSc in mathematical biology at the University of York, the molecular modelling course at Birkbeck, and the MSc in Bioinformatics at the University of Manchester (which started in 1994).

None of the recent initiatives would have worked if the problem of getting biologists and computer scientists working together had not been addressed. The key driver for this was the bioinformatics initiative set up jointly by the BBSRC and EPSRC in 1995, in which grants would only be awarded if the projects represented a real collaboration between biology and computer science. The provision of this relatively small, but ring-fenced pot of money, was crucial in getting biologists and computer scientists to begin a process of dialogue. Even in cases where grants were not funded links between the disciplines were being fostered which have now been realized in the number and range of master’s and PhD programmes on offer in the UK. Collaborations were, therefore, already in place and capable of responding to, and being strengthened by, the subsequent range of initiatives put forward by the various research councils. However, there are still problems which need addressing.

• The relationship between biology and computer science is still complicated and there is a potential for disputes over the ‘ownership’ of the discipline in an institute.

• Demand from students for places on master’s courses (MSc and MRes) is high and demand for these students once they finish the courses is high: employers are often willing to pay a premium for bioinformatics skills. However, students often leave bioinformatics courses with only a superficial knowledge of computer science and are expected to play key roles, often without support, as IT specialists.

• There is still a serious skills shortage at the postdoctoral level.

• There is the problem of being able to retain trained staff given the competitive salaries being offered in industry and abroad.

• The message from the research councils to support bioinformatics training is being received very clearly by the universities, many of which are actively attempting to recruit bioinformatics lecturers—but finding suitably qualified candidates is not easy.

• There are still problems to be faced in delivering bioinformatics teaching at the undergraduate level.

New challenges will be to broaden the scope of the education to become more mathematical—and to make the training available through new channels of delivery, such as the web (as is already happening with the courses at Manchester, Birkbeck/UCL and Nottingham Universities). The UK has made a good start in bioinformatics training—but there is no room for complacency.

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